640

IRD

Installation & Operation Manual

MODEL 1222

Vibration Monitor

Installation
&
Operation Manual

MODEL 1222
Vibration Monitor

REVISED

For Monitors with Serial Number Prefix "E"

IRD monitor vibration preset levels are to be established by the customer in accordance with his experience and that of the manufacturer of the equipment to be monitored.

The National Audio-Visual Training School and the Engineered Maintenance Control Training Program held in our Worthington Plant are available without charge to IRD customers. These schools provide the basic and effective information to understand vibration characteristics and their use as a KEY to machinery condition.

IRD MECHANALYSIS, INC.

SUBSIDIARY OF H. H. ROBERTSON COMPANY

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IRD #734G

Litho in U.S.A.

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INTRODUCTION

Vibration in rotating machinery is normal. When the vibration becomes excessive trouble is present.

The troubles that cause vibration are unbalance, misalignment, bad bearings, bent shaft, mechanical looseness, and others. Such troubles, if left undetected, can result in excessive wear, reduced service life, increased maintenance costs, and ultimately failure.

The IRD Model 1222 Vibration Monitor provides for continuous measurement of vibration. When the vibration exceeds the preset levels the monitor provides signals for a warning alarm and machine shutdown.

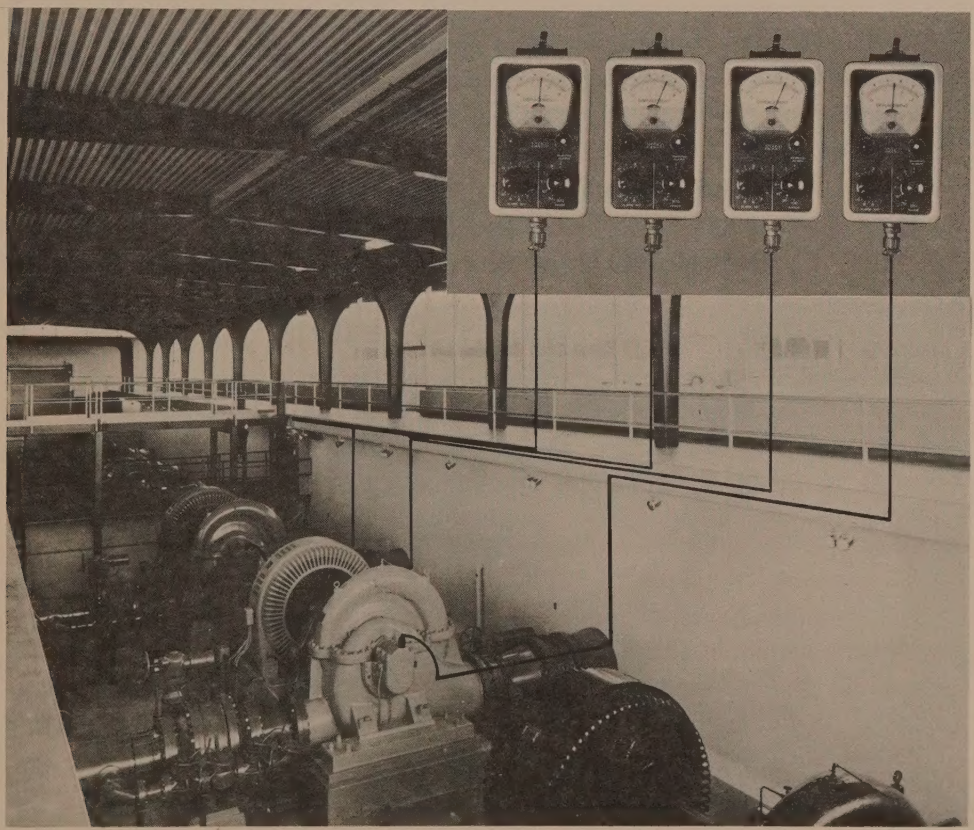


Fig.1 Typical Monitor Installation

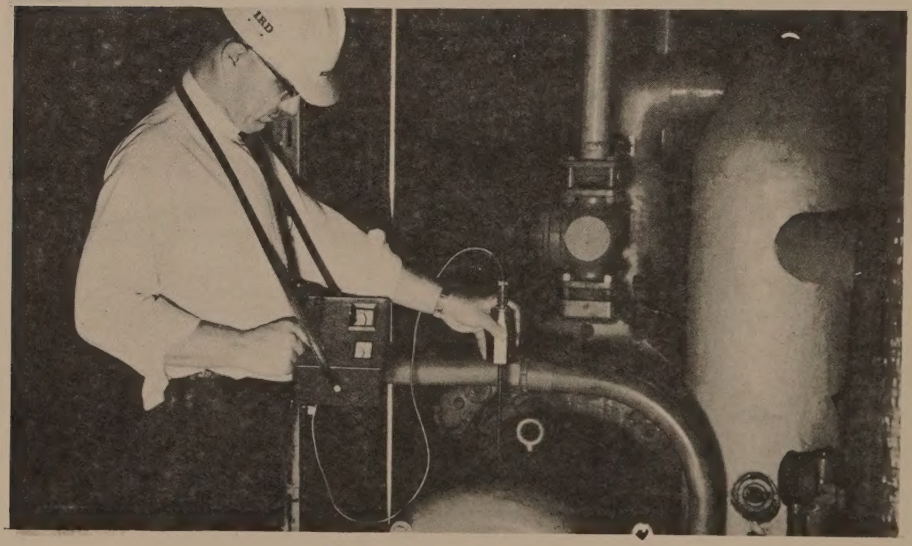
To do this important job the 1222 Monitor is equipped with:

1. A vibration pickup to sense the vibration and change it into an electrical signal.
2. A vibration meter to provide a continuous indication of the vibration present. (Very useful for making periodic checks.)
3. A warning alarm relay and light to provide a visual signal (flashing green light) and an external signal (relay operation) to operate a warning device.
4. A shutdown alarm relay and light to provide a visual signal (flashing red light) and an external signal (relay operation) to operate a shutdown device.

The following information is presented to instruct you on what the monitor is and does, how to install it, and how to properly apply it to your specific needs.

The key to effective monitoring is a good pickup location. Use the IRD 320 Vibration Selector to make accurate filtered readings of vibration, amount and frequency for comparison of likely spots. Use the Vibration Selector for spot checks and vibration analysis in your plant or in the field.

- Battery Operated
- Easy to Operate
- Transistorized
- No Special Training Required
- Weighs 9½ pounds, with leather carrying case



IRD 320 Vibration Selector

DESCRIPTION

The Monitor is housed in an aluminum case suitable for mounting in a panel or on a wall in any convenient location.

DISPLACEMENT METER

The DISPLACEMENT meter (Figure 2) provides a continuous indication of the peak-to-peak vibration displacement of the machine on which the vibration pickup is mounted. It has two separate scales. The 0 to 1.0 scale is used when the RANGE selector switch is at the .1, 1, 10 or 100 position. The 0 to 3.0 scale is used when the RANGE selector switch is at the .3, 3 or 30 position.

RANGE SELECTOR SWITCH

The RANGE selector switch (Figure 2) is used to select the full-scale DISPLACEMENT meter range in mils of vibration. A range from .1 mil to 100 mils full-scale is covered in seven (7) scales (1 mil = .001 inch). When the .3, 3 or 30 scale is selected, the 0 to 3 DISPLACEMENT meter scale is used. When the .1, 1, 10 or 100 scale is selected the 0 to 1 meter scale is used. (See Figure 3.)

Example #1: When the scale selected on the RANGE switch is 10 and the DISPLACEMENT meter indicates .5

a vibration of 5 mils is present.

Example #2: When the scale selected on the RANGE switch is 30 and the DISPLACEMENT meter indicates 2

a vibration of 20 mils is present.

ALARM SET CONTROL

The ALARM SET is a dual element control (Figure 2) for selecting the vibration level at which the *warning alarm* (black knob) and the *shutdown alarm* (red knob) are to operate. These controls are adjusted in relation to the reading of the DISPLACEMENT meter. The numbers on the ALARM SET control correspond to percent full scale of the meter range selected.

Example #1: It is desired to adjust the warning alarm for 5 mils and the shutdown alarm for 8 mils.

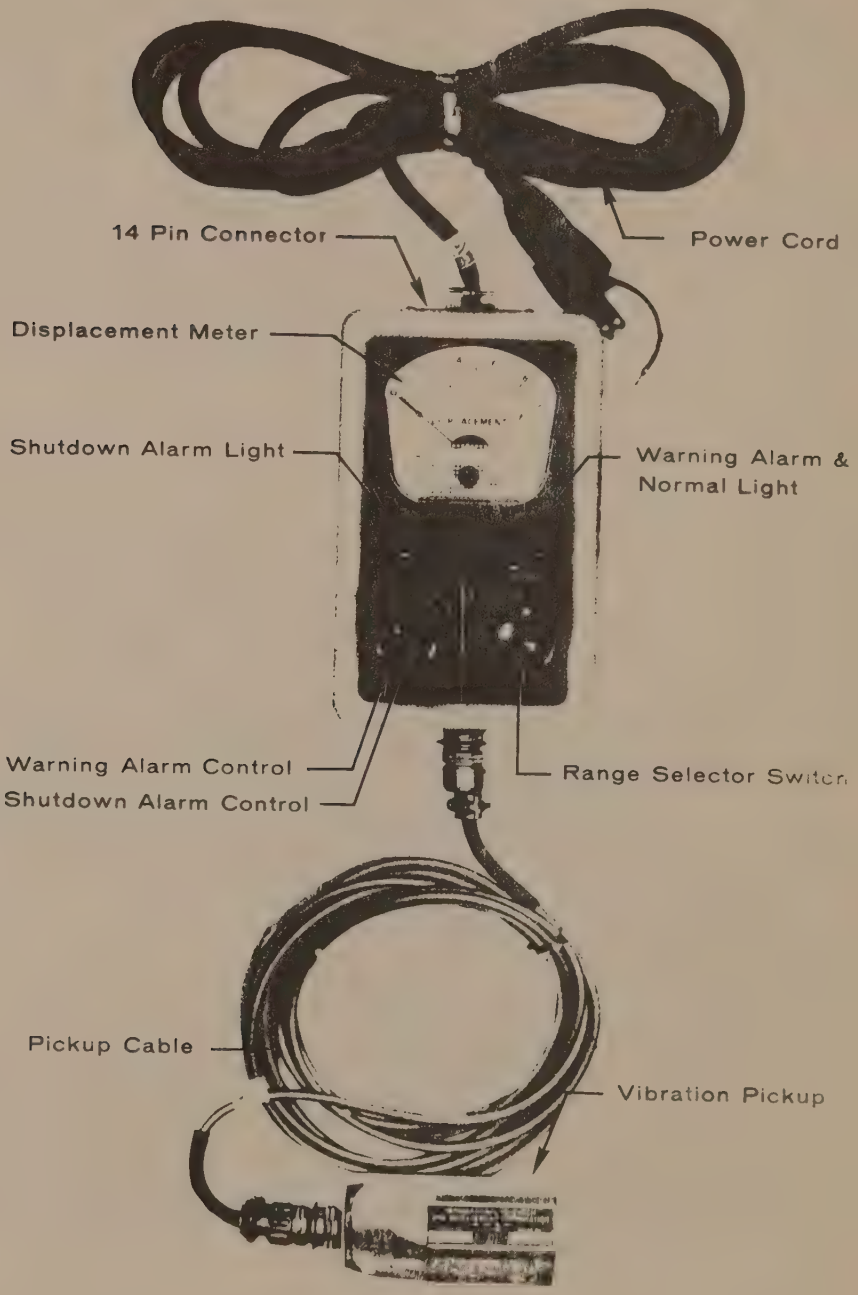


Fig. 2 Model 1222 Vibration Monitor

Set the RANGE selector switch at 10. (10 mils full scale)

5/10 = 50% Set the warning alarm control (black knob) at 5.

8/10 = 80% Set the shutdown alarm control (red knob) at 8.

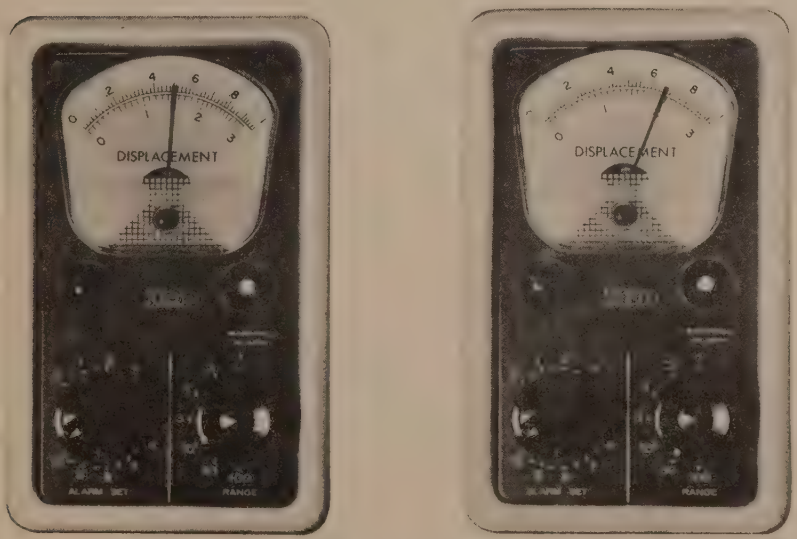
Example #2: It is desired to adjust the warning alarm for 2 mils and the shutdown alarm for 3 mils.
Set the RANGE selector switch at 3.

2/3 = 67% Set the warning alarm control (black knob) at 6.7.

3/3 = 100% Set the shutdown alarm control (red knob) at 10.

WARNING ALARM AND NORMAL LIGHT

The green light, *Fig. 2*, labeled WARNING ALARM, is illuminated when power is supplied to the instrument. A constant glowing green light indicates NORMAL operation. A *flashing* green light indicates the preset WARNING ALARM vibration level has been exceeded.



Example #1 5 mils Example #2 20 mils

Fig.3 Examples of two RANGE switch positions

SHUTDOWN ALARM LIGHT

The SHUTDOWN ALARM light, *Fig. 2*, is red and flashes on and off several times a second when the preset SHUTDOWN ALARM vibration level has been exceeded. The SHUTDOWN ALARM light is automatically reset, i. e., it will continue to flash until the vibration has fallen below the preset level. A manual reset is possible by using a switch external to the Monitor. When a manual reset switch is used and is in the manual position, the SHUTDOWN ALARM light is illuminated continuously until reset. For details on connecting a manual reset switch, see p. 15.

TIME DELAY

A built-in time delay circuit allows the Monitor to ignore transient vibration of small duration. Time delays from 3 to 10 seconds are factory set as specified. Longer time delays are available upon request. See APPLICATION NOTES section, p. 21 for information on protection against start-up vibrations.

VIBRATION PICKUP

The IRD Model 544 Vibration Pickup has a ¼" x 28 NF tapped hole ¼" deep in the bottom for mounting purposes. It is sensitive only to those vibrations along the long axis of the pickup. The pickup may be mounted in any attitude without effect. The preferred method of mounting the pickup is with the longer axis of the pickup pointing toward the rotating centerline of the shaft.

A special pickup housing is available to meet NEC Class II, Group E, F & G, and NEC Class I, Group D, explosion proof requirements.

CABLES

A 25 foot cable is normally furnished for connecting the Vibration Pickup to the Monitor. Cables up to 500 feet may be used. Standard connector MS 3106E-10SL-43 and Belden 8428 cable are used.

POWER

The Monitor can be powered by 117 volts AC 60 cycles or 12 volts DC. The desired source of power is connected to the power connector. Stand-by power can be

> **CAUTION**
> Only ONE source of power should be connected at one time.

wired to the Monitor by means of an external relay. This is discussed under INSTALLATION section, p. 16. The power requirement is 10 volt amperes. The 1222 Monitor is wired for 117 volts AC 60 cycle unless specified otherwise when ordered.

INTERNAL RELAY OPERATION

The 1222 Monitor is equipped with two (2) internal relays—warning and shutdown. When the vibration exceeds the preset warning or shutdown level, the respective relay coil is energized and operates the relay. This action opens the NC, *normally closed* contact and closes the NO, *normally open* contact. The respective light is also turned on. When the NC contact opens, the circuit which energized the the relay coil is broken and the relay returns to its normal position and the light goes out. If the vibration is still in excess of the preset level the relay operates again. In this manner the relay automatically resets itself and because of the interrupted action causes the light to flash. Any external warning or shutdown device connected directly to the alarm relay will operate in the same manner unless an external latching type relay is used for operating the warning or shutdown device.

The Monitor will operate satisfactorily if no external connections are made to the internal relays.

VELOCITY

The standard 1222 Vibration Monitor is designed to monitor the vibration displacement. If your 1222 Monitor has been modified to monitor the vibration velocity in inches per second the only apparent difference will be the full-scale ranges of RANGE selector switch.

The full scale ranges will be .03, 0.1, 0.3, 1.0, 3.0, 10.0, and 30.0 in/sec.

General operating procedures are the same except for the following. To use the chart in Figure 16 for determining the alarm vibration level it will be necessary to convert the displacement and frequency values to velocity in inches/second. Use the following formula:

$$V = 52.3\ D\ \frac{F}{1000} \times 10^{-3}$$

V = Max. Velocity in inches/second

D = Displacement (Peak-to-Peak) in Mils

F = Frequency in Cycles Per Minute

DC RECORDER OPERATION

The 1222 Vibration Monitor can be connected to operate most types of DC Recorders. A DC signal proportional to the measured vibration is provided at the 14-pin connector. This signal can be used to operate a DC Recorder. Different connections adapt the instrument for operation with both types of recorders–High Impedance and Low Impedance. A calibration control provides for fine adjustments to match signal output to the recorder being used. Details are covered in the OPERATION section of this manual.

SPECIFICATIONS

FREQUENCY RANGE

150 CPM to 150,000 CPM

DISPLACEMENT RANGE

0.000 005 inch to 0.1 inch in 7 ranges: 0 to 0.1 mil, 0 to 0.3 mil, 0 to 1.0 mil, 0 to 3.0 mils, 0 to 10.0 mils, 0 to 30.0 mils, 0 to 100.0 mils. (1 mil = .001 inch).

TWO (2) ALARM LEVELS

Shutdown and warning. Individually adjustable over entire Displacement Range.

TRANSIENT VIBRATION TIME DELAY

3 seconds standard for both alarm levels separately—factory adjustable for 3, 5, 7, 10 seconds. Longer time delay available on request.

ALARM RESET

Automatic is standard for both shutdown and warning. Manual reset is a simple field installation for shutdown only.

INTERNAL RELAY CAPACITY

117 volts, AC 8 amperes noninductive. 28 volts, DC, 10 amperes noninductive.

DC RECORDER OPERATION

Connections and calibration control provide for operation with most all types of DC Recorders. Output signal for Low Impedance recorders—80 micro amps (10,000 ohms) to 150 micro amps (50 ohms) full scale. Output signal for High Impedance Recorders—.5 volts DC (4300 ohms) to 1.6 volts DC (1 megohm) full scale.

SIZE

Monitor control unit size—4" x 7¾" x 4¾", with connectors. Weight 3½ pounds. Vibration pickup size 2¼" dia. x 4¾". Weight 22 ounces (Model 544). Shipping Weight 10 pounds.

POWER REQUIREMENTS

Choice of 105/127 volts, 50-60 cycle AC, 10 watts; or 12 volts DC, 10 watts. Regulated power supply handles to 50% ripple. 210/254 volts 50-60 cycle AC upon request.

TEMPERATURE RANGE

Monitor Control Unit 0° to 130° F.

Vibration Pickup—40° to 500° F. (Model 544 .

Drift with temperature change 0° to 130°. F = 3% shortime, = 5% longtime.

STANDARD EQUIPMENT

Vibration Pickup Model 544 (Waterproof).
110 volt AC, 8 foot, 3 wire power cord.
14 pin connector—for power, external relay, DC Recorder and manual reset connections.
25 foot pickup cable.
Installation and Operation Manual.

INSTALLATION

The 1222 Vibration Monitor may be mounted in any convenient location up to 500 feet from the vibration pickup. The recommended location is in a control area where prompt action can be taken in the event of an alarm. The Monitor unit should be protected from the weather if possible as the unit is not waterproof. Satisfactory operation is realized in temperatures ranging from 0° to 130° F.

The automatic reset feature of the internal alarm relays makes it possible to install the Monitor in completely unattended areas with alarm connections to an operating control room and existing annunciators.

MONITOR INSTALLATION

The Monitor may be panel mounted (recessed) or mounted on a post or wall (see Figure 4). Universal mounting brackets are supplied with each instrument. Nuts bolts, etc. are not supplied since these will change with various conditions. *If mounting recessed, remove set screw in rear of case and remove cover. Insert Monitor in recess and replace cover.*

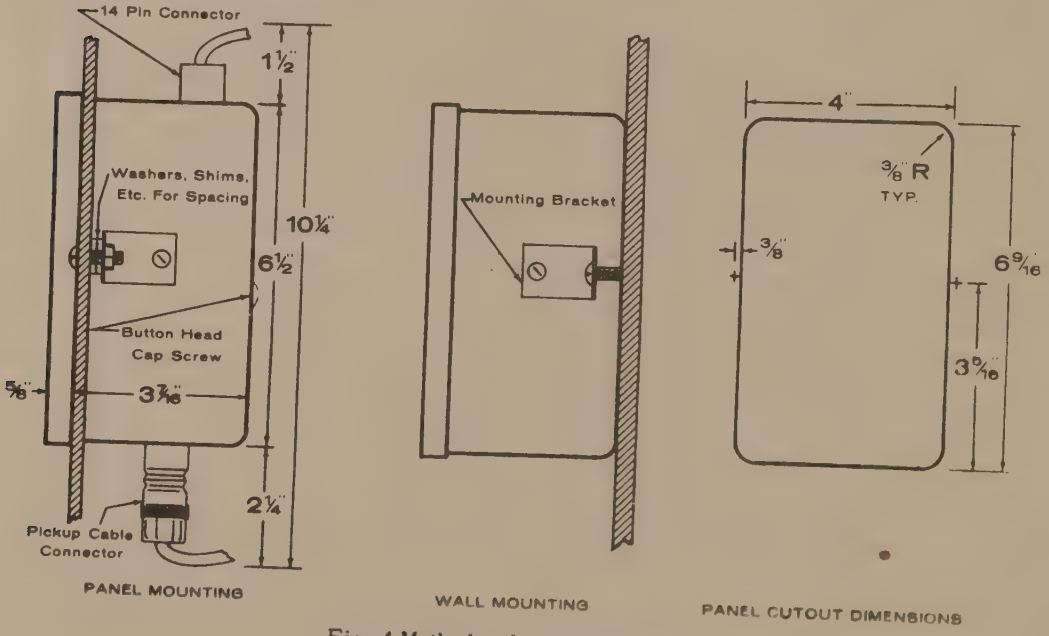


Fig. 4 Methods of mounting Monitor

VIBRATION PICKUP INSTALLATION

The key to effective monitoring is a good pickup location. The most logical place is on the most critical bearing housing. It is through the bearings of the machine that vibration forces are passed. Other points may be used so long as such a point has vibrations similar and proportional to those at the bearing housing.

The use of an IRD Model 306 Vibration Meter or Model 320 Vibration Selector to make accurate vibration readings for comparison of likely pickup locations is recommended. The 320 Vibration Selector is especially helpful as both displacement and frequency readings can be observed.

The vibration pickup is equipped with a 1/4"–28 NF x 1/4" threaded hole in the end cap for attaching to the machine to be monitored. A 1/4"–28 NF x 1/4" stud may be welded, brazed, or screwed to the machine for pickup installation. An alternate method using a mounting bracket may also be used. See Figure 5.

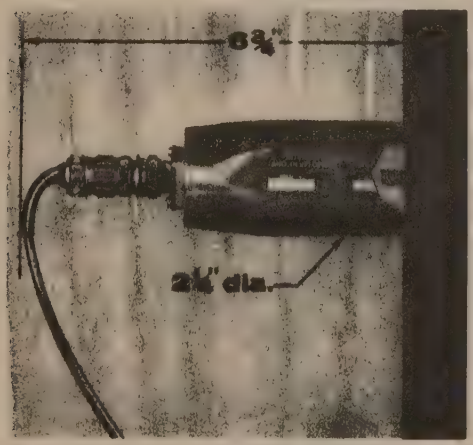


Fig. 5A Pickup mounted on machine

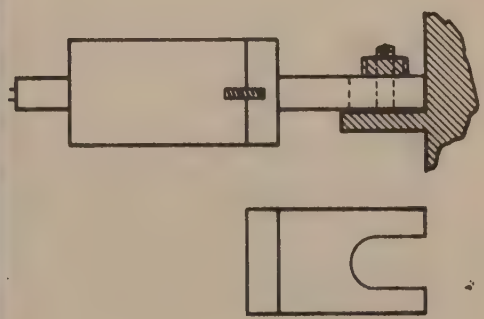


Fig. 5B Pickup attached to mounting bracket

The pickup should be mounted in such a way that the long axis is pointing toward the rotating centerline of the machine. This provides maximum sensitivity to vibration resulting from the troubles mentioned in the introduction.

As previously noted, special installations are required to meet NEC Class II, Group E, F & G, and NEC Class I, Group D, explosion proof requirements. For installations of this type, please refer to IRD Drawing Number C2-0734 which is included in this manual when the housing is ordered.

PICKUP CABLE

Belden #8428 cable is used for the pickup cable. If you wish to tailor pickup cable lengths to a particular monitor installation be sure to connect the black lead to Pin A in the pickup cable connector. The white lead is connected to Pin B in the pickup cable connector. The shield is connected to the connector housing. Use solder connections. Cable lengths to 500' will provide satisfactory operation.

14 PIN CONNECTOR

The 1222 Monitor is equipped with a 14 pin connector as shown in Figure 2, DESCRIPTION section, p. 4. To gain access to the connector pins loosen the clamp on the power cable, remove the nut from the end of the connector and remove the end cap by swinging it up and out. See Figure 6. The case may also be swung up and away from the connectors.

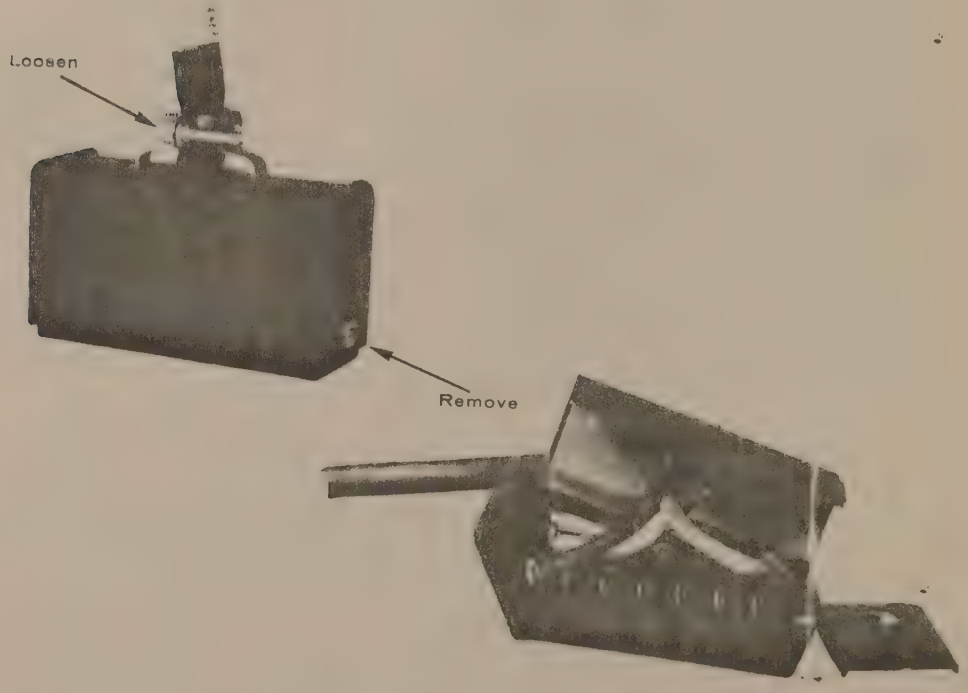
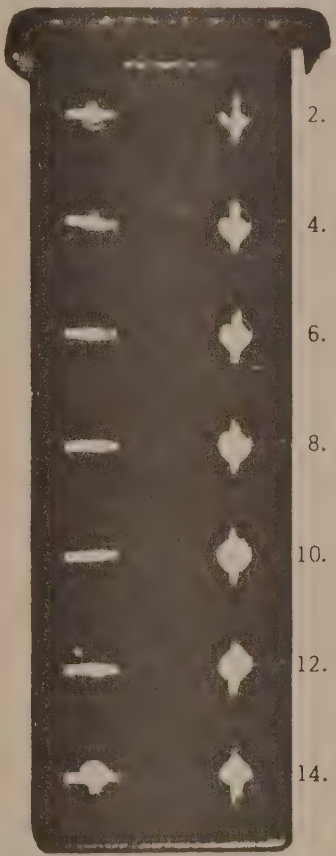


Fig. 6 Disassembling 14 pin connector

Figure 7 identifies each connector pin by number. Numbers shown do not actually appear on the connector. They are for identification only.



1. 117 volts AC 60 cps
2. 117 volts AC 60 cps
3. Wiper–Shutdown Alarm Relay
4. DC Recorder Output (negative)
5. Normally Open (NO)–Shutdown Alarm Relay
6. DC Recorder Output (Ref. page 22)
7. Normally Closed (NC)–Shutdown Alarm Relay
8. DC Recorder Output Calibration potentiometer wiper
9. Wiper–Warning Alarm Relay
10. 12 volts DC Positive
11. Normally Open (NO)–Warning Alarm Relay
12. Manual Reset for Shutdown only
13. Normally Closed (NC)–Warning Alarm Relay
14. DC Common Ground

Fig. 7 Connector Pin identification

POWER

The 1222 Monitor is wired for 117 volts AC 60 cycle unless a different power connection was specified when the unit was ordered. To connect for DC power operation refer to the following examples:

A. Connect Power Supply

To connect 117 volts AC 60 cycle power:

Connect to #1 and #2. If 3 wire power line is used, connect ground wire to #14.

To connect 12 volts DC:

Connect to #10 (positive) and #14

> CAUTION
> Only one source of power may be used at a time.

B. To connect the internal shutdown alarm relay to an external shutdown alarm device such as a light bulb, horn, or buzzer, one of the connections shown in *Figs. 8 and 9* may be used. *Numbers refer to pin connectors in Fig. 7.* For continuous alarm or automatic machine shutdown refer to *Fig. 10.*

> The external alarm device will operate intermittently in the same manner as the internal alarm relay.

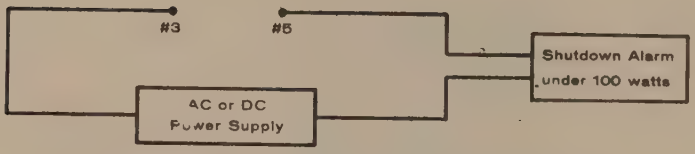


Fig.8 Shutdown Alarm device under 100 watts

Fig.9 Shutdown Alarm device over 100 watts

Fig.10 Continuous Alarm or automatic machine Shutdown

The latching type relay illustrated in *Fig. 10* is especially recommended where the external alarm or shutdown device is located a great distance away from the Monitor itself, as it can be reset electrically.

C. The intermittent operation of the internal shutdown alarm relay is a result of its automatic reset feature thus making it unnecessary to adjust the Monitor in the event of a shutdown alarm. It is possible to provide for manual reset of the internal alarm relay by connecting a single pole single throw switch to pins #12 and #14. The manual reset switch and connecting wires should not have more than 2 ohms resistance. Allow one (1) ohm for the switch and solder connections and use #18 stranded copper wire up to 60 feet long for connecting the switch. The switch should be rated at 117 volts and 0.5 amperes.

Fig.11 Manual Reset

Switch is shown in Manual position *closed.*

Switch in open position is Automatic reset.

The connections in *Figs. 8, 9, 10, 12, 13, and 14* used the wiper contact and the normally open contacts of the alarm relay to make the circuit for a power supply to actuate an alarm device or slave relay. The normally closed contacts #7 and #9 may also be used when desired. The only difference in connections would be that of holding a slave relay in the closed position instead of the open position.

To reset the shutdown alarm relay move the switch from Manual position, *closed,* to Automatic, *open.*

The Manual reset switch may be substituted for a latching type relay or wherever the intermittent operation of an alarm or shutdown device is undesirable.

D. To connect the warning alarm relay to actuate an external warning alarm one of the connections shown in Figures 12, 13, or 14 may be used.

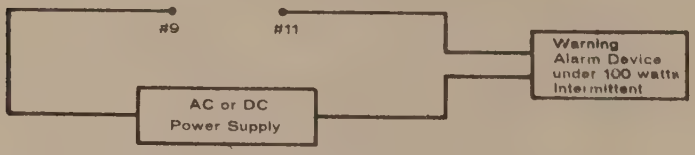


Fig.12 Warning Alarm device under 100 watts

Fig.13 Warning Alarm device over 100 watts

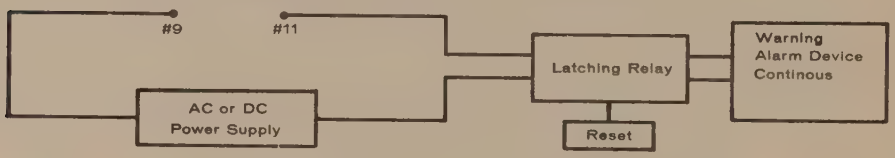


Fig.14 Continuous Warning Alarm

E. If the machine being monitored is operable on stand-by power in the event of a main power failure, the 1222 Monitor can also be connected to operate on stand-by power. Stand-by power available should be 117 volts AC or 12 volts DC.

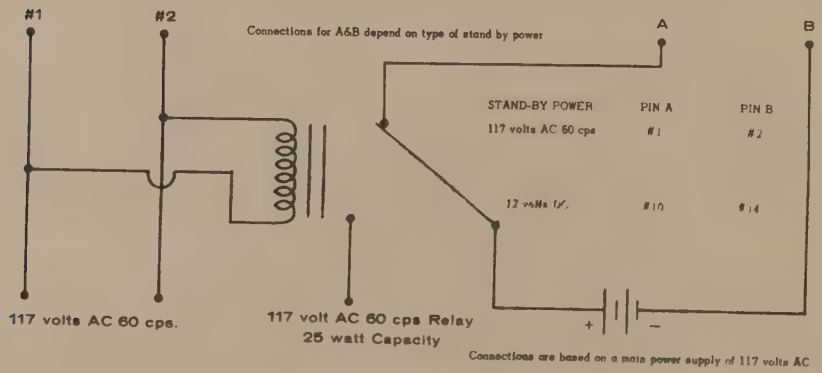


Fig.15 Connections for stand-by power

OPERATION

After the Monitor installation has been completed the next step should be a check of the system.

NORMAL OPERATION

The instrument is turned on when the power cable is connected to the power source and the 14 pin connector attached. There is no on/off switch as the Monitor is designed for continuous operation. A switch may be installed in the power cable if desired. Adjust the ALARM SET controls to 10 (100% full-scale).

> **CAUTION**
> During the following procedure disconnect power to external alarm and relay devices so they do not operate during tests.

The vibration pickup should be attached to the machine to be monitored or some other source of vibration. The pickup cable should also be connected. The DISPLACEMENT meter should indicate vibration.

If the meter pointer is off scale to the right, turn the RANGE selector switch to successively higher ranges until the meter pointer indicates on scale. If the meter pointer indicates less than 1/3 full scale turn the RANGE selector switch to successively lower ranges until the meter pointer indicates 1/3 full scale or more. The green (WARNING ALARM) light should be on indicating normal operation.

If the green light is on and there is no vibration indicated on the meter, check continuity of the pickup cable.

If the green light is not illuminated and vibration is indicated on the meter, check the bulb.

If the green light is not illuminated and no vibration is indicated even on the smallest (0.1) range check instrument power connections.

If the green or red light is flashing on and off, check to see that the ALARM SET controls are pointing at 10 (100% full-scale) and the meter indicates less than full-scale. If meter indicates full-scale select the next larger range.

INTERNAL WARNING ALARM RELAY

To check the WARNING ALARM relay and light turn the black ALARM SET control to a setting equivalent to the percent full-scale meter indication. The green (WARNING ALARM) light should flash on and off several times a second. Return the black ALARM SET control to the setting of 10. The green light should stop flashing and remain illuminated.

EXTERNAL ALARM

Connect the external alarm devices to their respective power supplies and repeat the above tests. The external alarm devices should operate at the same time as the ALARM lights.

ADJUSTING THE WARNING AND SHUTDOWN LEVEL

There are two general methods for determining the vibration level at which you wish a warning or shutdown to be made.

Method I

Vibration is always present in a machine, even when it is in good condition. When trouble develops the vibration will increase. Hence you may wish to monitor for an increase in vibration. The warning level selected can be based on the vibration already present. The Monitor's warning can be set, at say, twice the level of vibration already present in the machine. Using a factor of two will normally allow for changes in vibration due to load changes, etc. The shutdown level may then be set at a corresponding higher value but on the same full-scale meter range.

Method II

The warning and shutdown vibration level may be determined from the manufacturer of the machine, or the Vibration Chart, Figure 16, OPERATION section, p. 19. This chart applies to most rotating machinery. For precision machine tools use the Tentative Guide for Machine Tools, Figure 17, OPERATION section, p. 20. If external shutdown and warning connections have been made, disconnect their power supplies when adjusting the alarm levels.

An example for setting the alarm level is as follows. You desire to monitor a large induced draft fan which periodically gets out of balance to the extent that the

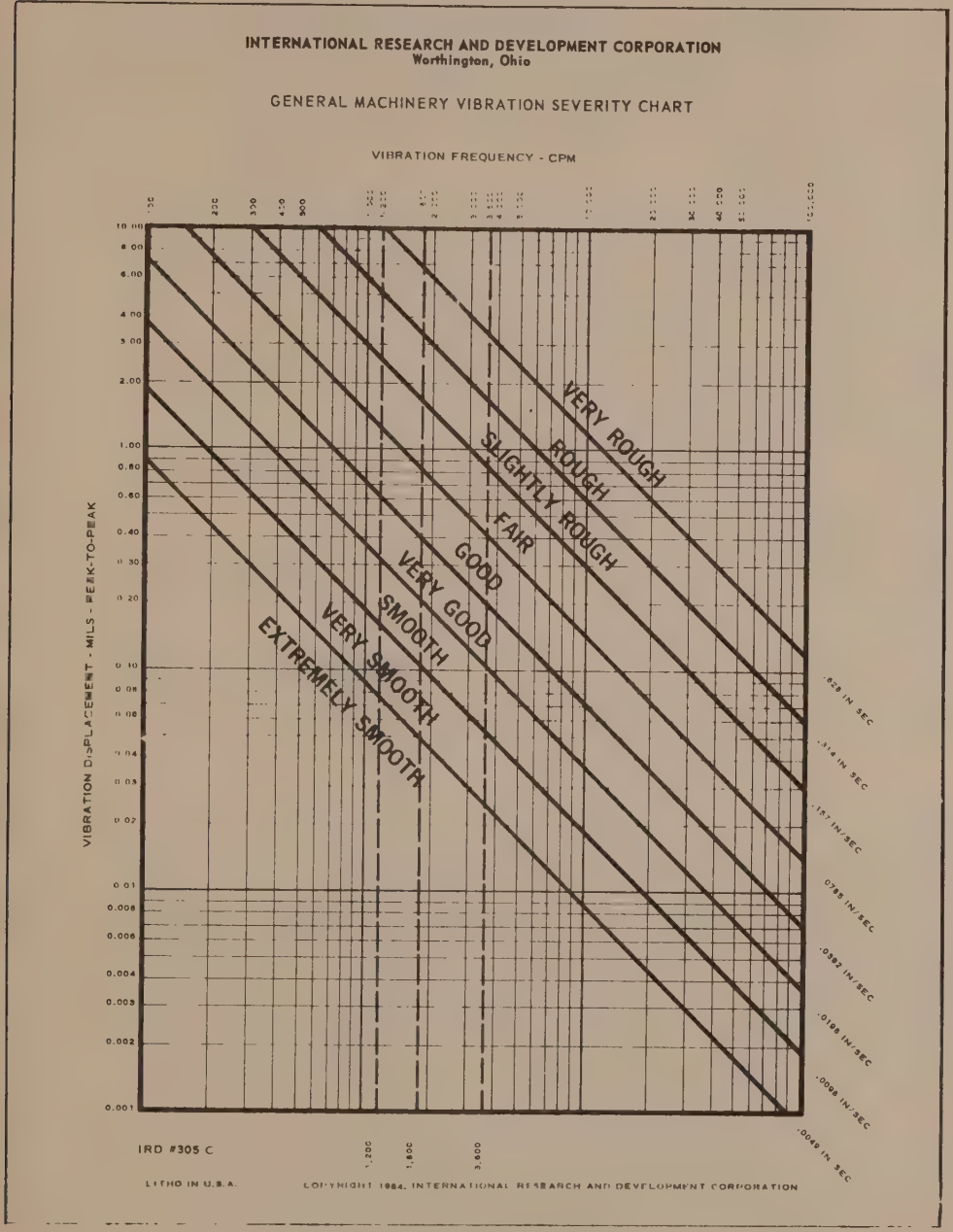


Fig. 16 Vibration Chart

TENTATIVE GUIDE TO VIBRATION TOLERANCES FOR MACHINE TOOLS

TYPE OF MACHINE	Displacement of vibrations as read with pickup on spindle bearing housing in the direction of cut.
Grinders	**Tolerance Range**
Thread Grinder	.01 — .06 mils
Profile or Contour Grinder	.03 — .08 mils
Cylindrical Grinder	.03 — .10 mils
Surface Grinder (vertical reading)	.03 — .2 mils
Gardner or Besly Type	.05 — .2 mils
Centerless	.04 — .1 mil
Boring Machine	.06 — .1 mil
Lathe	.2 — 1.0 mils

These values come from the experience of IRD personnel who have been troubleshooting machine tools for over 10 years with the IRD equipment. They merely indicate the range in which satisfactory parts have been produced and will vary depending upon size and finish tolerances.

IRD #192

Fig. 17 Tentative guide for machine tools

vibration of the machine gets hazardous and is harmful to the bearings. The fan runs at a speed of 1200 RPM. The normal vibration level is approximately 1 mil (.001 inch). The vibration chart in Figure 16, OPERATION section, p. 19, shows that a vibration of 5 mils is considered very rough. We will set the monitor warning alarm level at 5 mils. This is done by selecting the 10 range with the RANGE selector switch and then setting the warning ALARM on 5 (black control). The SHUTDOWN ALARM can then be set at any corresponding higher vibration level up to 10 mils (100% of full scale) using the red control.

> Both warning and shutdown levels must be set on the same full-scale range.

APPLICATION NOTES

The following is offered for your information so you may realize the best possible results from your Monitor.

BACKGROUND VIBRATIONS

The 1222 Vibration Monitor is designed for continuously guarding a machine from excessive vibrations which are indications of trouble present or impending. Occasionally a machine will vibrate because of some other machine. Such vibrations are called background vibrations. Rarely do background vibrations cause serious trouble in a machine, but they can mask the vibrations in a machine which are indications of trouble.

When this is the case it is necessary to filter out the background vibration. Electronic filters are available for this purpose. To determine your needs for a filter, measure the background vibration on the machine while it is not operating. Measure both displacement and frequency. Then, measure displacement and frequency for all vibration while the machine is running. Any IRD Vibration Analyzer with a tunable filter will do this job.

With this information IRD can recommend a filter to meet your requirements.

START-UP VIBRATIONS

Machines often have considerable vibration during start-up and then operate smoothly at their normal operating speed. Such a condition is not unusual nor is it an indication of any major trouble. However, if the start-up vibrations are excessive they can cause the Monitor to give an alarm. Such an alarm is both unwarranted and undesirable. A suitable filter can be used to overcome such a problem. In many cases the same filter used to block out background vibration may also be used for this purpose.

To determine the filter needs it is necessary to know the normal operating speed and at what speed during start-up the maximum vibration occurs. With this information IRD can recommend a filter to meet your requirements.

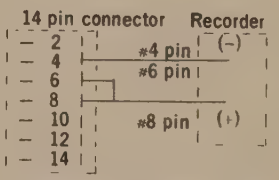
The filters discussed above are installed between the pickup cable and the instrument and do not normally require a power supply.

RECORDING VIBRATION

A DC Recorder may be connected to the 1222 Monitor to provide continuous vibration records of the machine being monitored. The DC signal output of the 1222 Monitor is directly proportional to the instrument's meter reading in percent of full scale. In other words, the DC signal output for a 2 mil reading would be the same for a 20 mil reading on the 3 mil and the 30 mil scale ranges respectively.

The connections required for recorder operation depends upon the type of recorder used. There are basically two types–High Input Impedance and Low Input Impedance. Low Input Impedance recorders usually specify the requirements for full scale deflection in micro-amperes. The connections for this type recorder provide a maximum current for full scale meter indication of the 1222 Monitor depending on the recorder input impedance as listed in the following table.

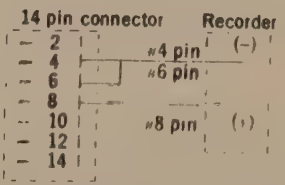
Recorder Input Impedance	Max Full Scale Current Output
50 ohms	150 microamps
1100 ohms	140 microamps
2700 ohms	120 microamps
5,000 ohms	100 microamps
10,000 ohms	80 microamps



Connection for output to LOW IMPEDANCE DC Recorder

High Input Impedance recorders usually specify the requirements for full scale deflection in volts. The connections for this type recorder provides a maximum voltage for full scale meter indication of the 1222 Monitor depending on the recorder input impedance as listed in the following table.

Recorder Input Impedance	Max Full Scale Voltage Output
4300 ohms	0.5 volts DC
15,000 ohms	1.0 volts DC
1 megohm & up	1.6 volts DC



Connection for output to HIGH IMPEDANCE DC Recorder

To calibrate the 1222 Monitor with the recorder used, make the appropriate connections in the 14-pin connector. Then using a signal generator (see CALIBRATION section for details) provide a signal sufficient to provide full scale indication on the meter of the 1222 Monitor. Any convenient meter scale range may be used. With the 1222 meter indicating full scale adjust the signal output, using the control located just in front of the pickup input connector, until the recorder also indicates full scale. It would be advisable to adjust the output so scale divisions on the recorder correspond to scale divisions on the meter. This will simplify reading values from the recordings.

VIBRATION ANALYSIS

We monitor vibration to guard against failures which result from a number of different types of troubles. When a vibration alarm is given the reason could be unbalance, misalignment, bad bearings, bent shaft, mechanical looseness, and many others. Deciding what trouble is present can be a difficult problem.

An IRD Vibration Analyzer like the Model 600 is used to analyze a machine's vibration to find out what type of trouble is present. This is possible because each trouble has its own unique vibration characteristics. For instance–unbalance has a frequency equal to the RPM, bad antifriction bearings cause a very high frequency shake, and so on. When the vibration is caused by unbalance, the Model 600 Vibration Analyzer can be used to balance the machine, in-place, without disassembly in most cases.

IRD's Audio-Visual Training Program teaches you how to analyze vibration to pinpoint trouble and do in-place balancing. Thousands have learned and are applying this technique to save time and money on all types of machines in all kinds of industry.

VIBRATION MEASUREMENT

Not all machines are so critical to an operation that they require vibration monitoring. But, they are subject to the same kinds of trouble.

Taking periodic vibration measurements with the IRD Model 306 Vibration Meter or IRD Model 320 Vibration Selector can detect trouble early in the game so correction can be scheduled. Because these instruments are battery operated they can be used easily anywhere in the plant or in the field.

For further details write IRD or contact the nearest district office.

CALIBRATION

Two methods are used to calibrate the Model 1222 for use with a particular pickup.

The first of these methods involves the use of an audio signal generator which is adjusted to give a signal output equal to the pickup signal at a given frequency and load. This signal is then applied to the input of the Model 1222 and the alarm and meter control are adjusted to read the displacement, double-amplitude, corresponding to that pickup signal output. This method affords a rapid pickup and instrument-check, and in most applications will be found useful.

Before calibration may be made, the pickup sensitivity must be known. This sensitivity must be MVRMS at 100 CPS for .001 inch peak-to-peak. If the sensitivity is in MVRMS/INCH/SEC. conversion may be made as follows:

$e_o = K\pi fA$

Where e_o = MVRMS at 100 CPS for .001 INCH P-P

K = MVRMS/INCH/SEC. A = .001 INCH P-P

f = 100 CPS $\pi = 3.14$

The sensitivity of the IRD Model 544 Vibration Pickup normally supplied with the Model 1222 is 240 MVRMS ± 10% at 100 CPS for .001 inch peak-to-peak displacement. The exact sensitivity of the Model 544 pickups with serial number prefix "C" and on is indicated by the last three digits of the serial number. For the exact sensitivity of any other Model 544 pickup write to IRD giving the serial number.

For identification and location of the alarm and meter gain adjustments see the block diagram and chassis layout, Figure 18, p. 25, CALIBRATION section. The procedure for calibrating the Model 1222 for use with a velocity type pickup is as follows:

1. With the 14 Pin Connector removed, zero the DISPLACEMENT meter by means of the small adjusting screw located on the front face of the meter. Reconnect the 14 Pin Connector.

2. Turn the RANGE switch to the 1 mil position. Short the pickup input connector. The warning alarm should energize when the warning ALARM SET (black knob) control is set for 0. The shutdown ALARM SET (red knob) control should be set at 10. Adjust the WARNING ALARM ZERO ADJUST control, if required, so the alarm energizes within less than 10% of 0.

Repeat this checking for the shutdown ALARM SET control by reversing the ALARM SET control settings outlined.

3. Apply a signal to the Input connector (see the block diagram, Figure 18).

4. Adjust the signal generator for the pickup sensitivity in MVRMS at 100 CPS.

5. The DISPLACEMENT meter should read full scale on the 1 mil range and the ALARMS should energize at 100% full scale. If they do not, adjust the alarms and meter gain controls until a full scale meter reading is obtained (1 mil) and ALARMS energize at 100% full scale.

The alarm and meter gain controls of the Model 1222 will now be adjusted for proper operation.

The second method of calibration is to use an accurate shaker table system. The pickup may be subjected to a known vibration and the alarm and meter gain controls adjusted as previously outlined. This method should only be used for pickups whose serial number has no prefix or has prefix "A" or "B".

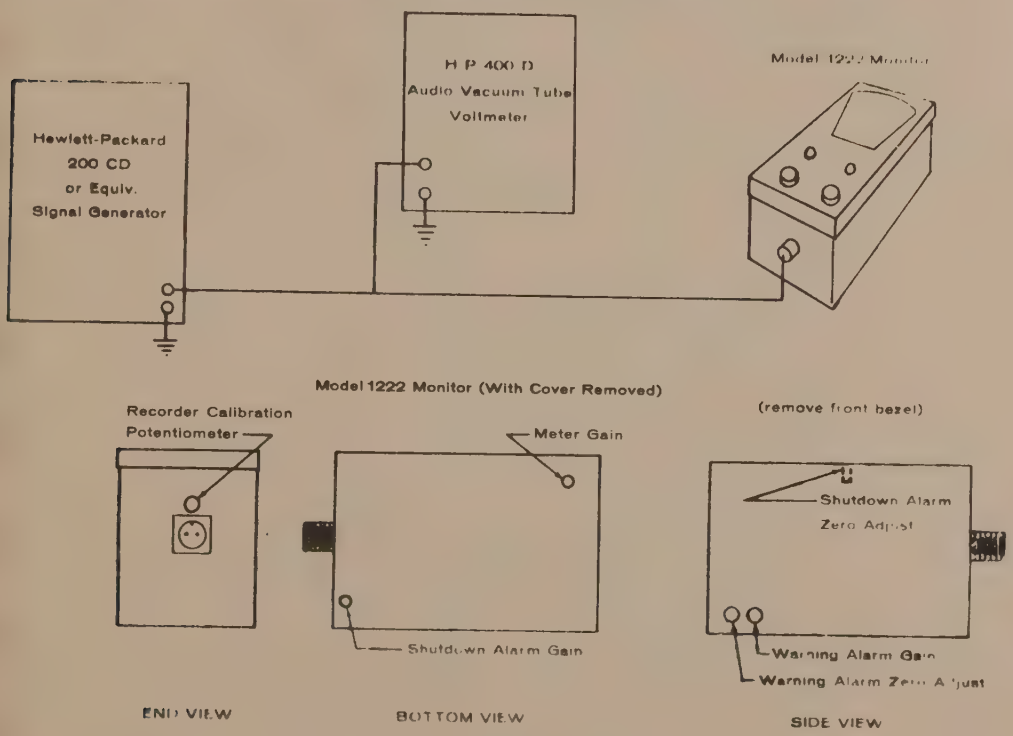


Fig. 18 Block diagram & chassis layout

MAINTENANCE

This section contains general information on maintenance and includes a schematic and parts list. Since the Model 1222 is constructed entirely of transistors, extreme caution must be taken when measuring voltages, etc. *Always use a VTVM to measure circuit parameters since the voltage at the probes of a VOM may damage the transistors.*

The following list can be used as an aid in locating and correcting some of the failures that may occur. Standard servicing techniques known to most qualified electronic service technicians will apply when more serious failures occur.

TROUBLE	CHECK
1. Power is applied to instrument but the green light is out.	a. Be sure power connections have been correctly made at terminal box. b. Check continuity of green bulb or replace.
2. Meter does not indicate - green bulb glows continuously.	a. Check continuity of meter movement. b. Check pickup with sensitive AC-VTVM or ohm meter. c. Check pickup cable continuity.
3. ALARM will not automatically reset.	a. Check manual reset switch, if installed. b. Check for shorted manual reset cable, if installed. c. Check internal relays for proper operation.

Refer to schematic diagram for details.

PARTS LIST

SCHEMATIC REF. #	IRD PART #	DESCRIPTION
Resistors		
R1	5004	68K 1/4W ±1%
R2	5003	22K 1/4W ±1%
R3	5002	6800 Ohm 1/4W ±1%
R4	5001	2200 Ohm 1/4W ±1%
R5	5000	680 Ohm 1/4W ±1%
R6	4999	220 Ohm 1/4W ±1%
R7	2877	100 Ohm 1/4W ±1%
R8	3597	1.3M
R9	2906	12K
R10	3491	150K
R11	1559	10K
R12	1598	22K 1/2W ±5%
R13	1559	10K
R14	1591	2.2K 1/2W ±5%
R15	3603	51K
R16	1559	10K
R17	1559	10K
R18	3604	110 Ohm
R19	3598	1.8K
R20	1564	33K
R21	1559	10K
R22	3600	4.7K
R23	3600	4.7K
R24	3600	4.7K
R25	3600	4.7K
R26	3599	47K
R27	4318	51 Ohm HW 5%
R28	4315	50K 1/5W ± 20%
R29	3600	4.7K
R30	3657	3740 Ohm
R31 & 36	3910	1K/1K Dual Element 10% W/S Taper Potentiometer
R32	5136	10K 1/2W ±10%
R33	4315	50K 1/5W ± 20%
R34	3599	47K
R35	3600	4.7K
R37	5136	10K 1/2W ±10%

SCHEMATIC REF. #	IRD PART #	DESCRIPTION
Resistors		
R38	1546	900 Ohm
R39	3657	3740 Ohm
R40	3601	150 Ohm
R41	3601	150 Ohm
R42	1546	900 Ohm
R43		
R44	5256	20 Ohm 1.5W 5%
R45		
R46	5257	40 Ohm 1.5W 5%
R47	3610	10 Ohm
R48	3612	7.5 Ohm 5W 5%WW
R49		
R50	4337	47 Ohm 1/2W ± 5%
R51	4337	47 Ohm 1/2W ± 5%
R52		
R53	1559	10K
R54	1564	33K
R55	3600	4.7K
R56	1584	100 Ohm 1/2W ±5%
R57	3598	1.8K
R58	3125	24K
R59	3574	20K 1/5W ± 20%
R60	3604	110 Ohm
R61	3598	1.8K
R62	1598	22K 1/2W ±5%
R63	1546	900 Ohm
R64	1559	10K Ohm
R65	1600	33K 1/2W ± 5%
R66	1596	10K 1/2W ± 5%
R67	1593	4.7K 1/2W ± 5%
R68	1584	100 Ohm 1/2W ± 5%
R69	1590	1.8K 1/2W ± 5%
R70	4336	50K 1W ± 20%
R71	1593	4.7K 1/2W ± 5%
R72	4671	1 Ohm 1W ±5%

NOTE: All resistors are 1/2W 1% unless otherwise specified

SCHEMATIC REF. #	IRD PART #	DESCRIPTION
Capacitors		
C1	3530	3 MFD 12V
C2	3530	3 MFD 12V
C3	3613	500 MFD 15V
C4	3506	0.1 MFD 50V 1%
C5	3605	100 MFD 12V
C6	3531	500 MFD 3V
C7	3531	500 MFD 3V
C8	3532	25 MFD 12V
C9	3531	500 MFD 3V
C10	3605	100 MFD 12V
C11	3605	100MFD 12V
C12	3490	5 MFD 6V NP
C13	3490	5 MFD 6V NP
C14	3607	50 MFD 12V
C15	3607	50 MFD 12V
C16	3608	.015 MFD 200V
C17	3608	.015 MFD 200V
C18	3608	.015 MFD 200V
C19	3608	.015 MFD 200V
C20	3615	1000 MFD 15V
C21	3615	1000 MFD 15V
C22	3531	500 MFD 3V
C23	3538	20 MFD 3V
C24	3607	50 MFD 12V
C25	3607	50 MFD 12V
C26	3614	500 MFD 25V
C27	3615	1000 MFD 15V
C28	3613	500 MFD 15V
C29	3607	50 MFD 12V
C30	3531	500 MFD 3V
C31	3607	50 MFD 12V
C32	3538	20 MFD 3V
C33	4672	2X .005 MFD. 1000V
C34	4672	2X .005 MFD. 1000V
Diodes		
D1	1380	1N67A
D2	1380	1N67A
D3	1380	1N67A
D4	1380	1N67A
D5	1380	1N67A
D6	1380	1N67A

SCHEMATIC REF. #	IRD PART #	DESCRIPTION
D7	1380	1N67A
D8	1380	1N67A
D9	3565	FW200
D10	3567	1N3019B
D11	5254	1N2974B
D12	1380	1N67A
D13	1380	1N67A
D14	1380	1N67A
D15	1380	1N67A
Semiconductors		
Q1	3893	2N1711 Selected for low noise
Q2	3893	2N1711
Q3	3893	2N1711
Q4	3893	2N1711
Q5	3579	2N1671B
Q6	3579	2N1671B
Q7	3564	2N2322
Q8	3564	2N2322
Q9	3893	2N1711
Q10	3893	2N1711
Q11	3893	2N1711
Q12	3893	2N1711
Miscellaneous		
SW1	3508	1 pole 7 Pos. Shorting Switch
K1	3578	32 Ohm 6V DC DP DT Relay
K2	3578	32 Ohm 6V DC DP DT Relay
PL1	5255	#1490 3.2V Min Light Bulb
PL2	5255	#1490 3.2V Min Light Bulb
M1	4976	0-50 Micro Amp D.C. Meter
T1	3573	12.6V 0.5 Amp. Transformer
P2	1179	MS3102A 10SL 4P Connector
P1	3570	14 Pin Male Connector
S1	3571	4 Pin Male

ACCESSORY PRODUCTS

CABLES

Additional cables are available in the following lengths:*

	IRD Part No.
4 Foot Pickup Cable	2482
12 Foot Pickup Cable	2484
25 Foot Pickup Cable	2485
50 Foot Pickup Cable	2486
75 Foot Pickup Cable	2487
100 Foot Pickup Cable	2488
15 Foot High-Temperature Pickup Cable	2495
50 Foot High-Temperature Pickup Cable	2496
20 Foot Power Extension Cable (2 wire)	2503

*Please specify length for cables over 100 feet.

MAGNETIC PICKUP SHIELD–IRD PART NO. 1157

This accessory is available to reduce the effects of a strong magnetic field in an area where the pickup must be mounted. It is a simple device for reducing the effect of stray magnetic fields by a factor of 10:1.

On special orders, a similar shield can be purchased that has a 40 db attenuation offering a 100:1 reduction in the effects of a magnetic field.

This accessory is quickly attached to the pickup and can be attached to any stud to which pickup can be mounted.

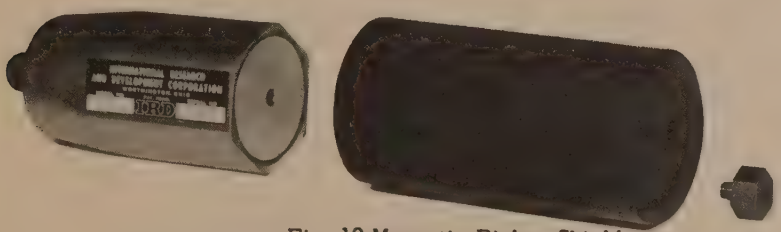


Fig. 19 Magnetic Pickup Shield

HAZARDOUS AREA HOUSING FOR MODEL 544 VIBRATION PICKUP

Hazardous Area housing is available for the Model 544 Vibration Pickup to meet NEC Class I, Group D, or NEC Class II, Group E, F and G, explosion proof requirements, when equipped with appropriate fittings and conduit.

If it is desired to provide for the use of the Monitor in NEC Class I, Group D, hazardous areas, then rigid conduit must be used. For such installations the following equipment is required and should be procured in accordance with installation requirements:

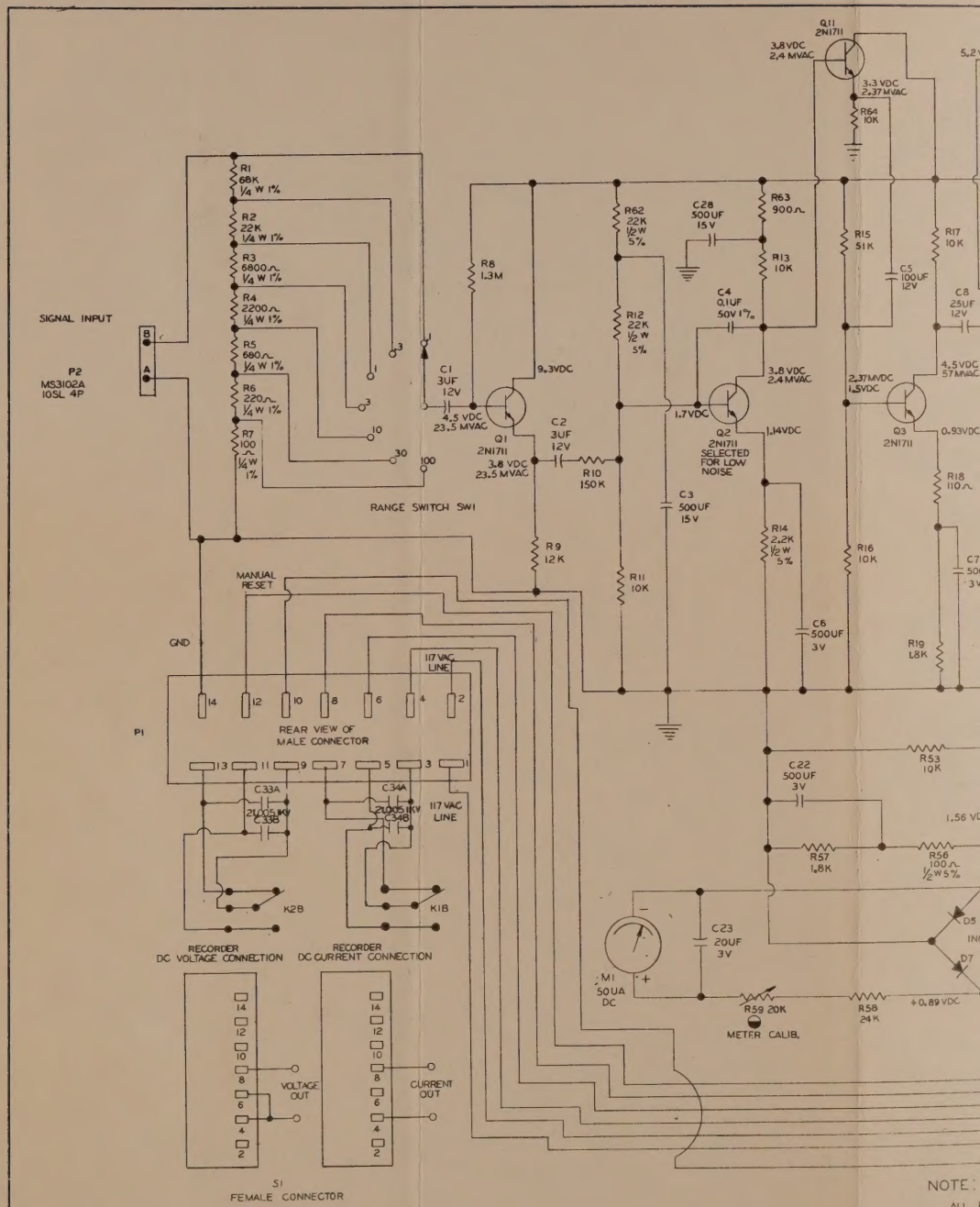
1. Conduit–Standard 1/2" rigid conduit
2. Seal Fittings–Crouse Hinds Type EYS-1 with 1/2" threaded end.
3. Flexible Coupling–Crouse Hinds Type ECJ-14

As an alternate to rigid conduit, a more flexible cable, General Cable Co. Type MI Cable may be used. General Cable Co. Type MI, #18 two conductor, 300 volt, low energy cable should be specified. Fittings should be Type H termination to fit standard 1/2" threaded hole.

Care must be taken when using rigid conduit so that vibrations are not damped by the rigid installation. A Crouse Hinds flexible coupling Type ECJ-14 should be used. If MI cable is used, make a 6" loop in the cable before attaching the vibration pickup.

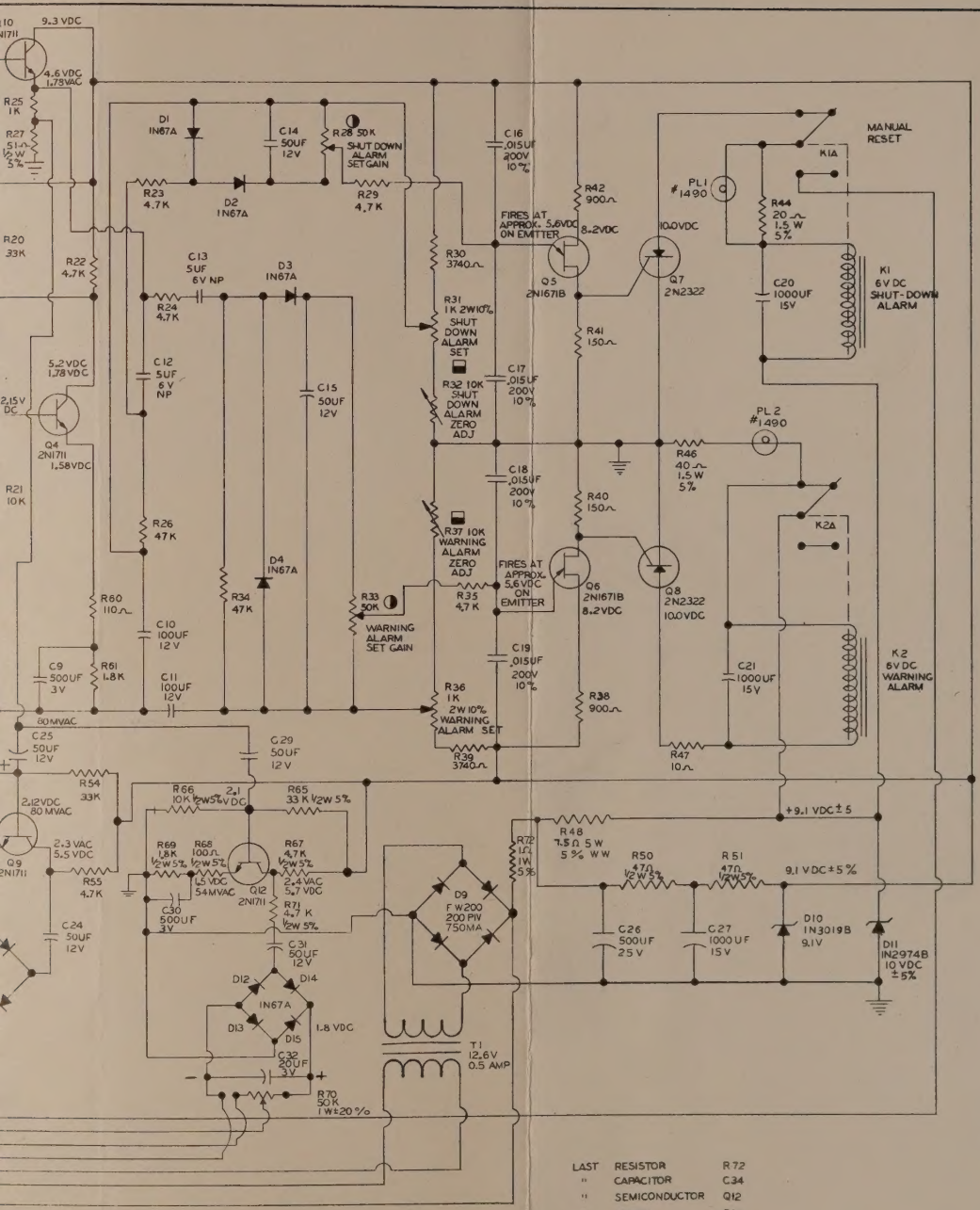
To meet the NEC Class II, Group E, F and G, requirements the following equipment is required:

1. Neoprene Pickup Cable suitable for operation in Class II, Group E, F and G, hazardous locations.
2. Seal fittings–Crouse Hinds Type EYS-1. For installation refer to IRD Drawing Number C2-0734.



NOTE: TO OPERATE ON 12VDC EXTERNAL POWER SOURCE CONNECT SOURCE POSITIVE TO PIN #10 AND NEGATIVE TO PIN #14 OF FEMALE CONNECTOR

NOTE: ALL VOLTAGES MEASURED WITH SINEWAVE INPUT SIGNAL OF 240 MV RMS @ 100 CPS WITH RANGE SWITCH ON 1 MIL POSTION. ALL VOLTAGES POSITIVE WITH REFERENCE TO COMMON GROUND MEASURED WITH VTVM. ALL AC VOLTAGES ARE RMS VALUES. POWER FOR ALL ABOVE MEASUREMENTS WAS 117 VAC 60 CPS.



LAST	RESISTOR	R72
"	CAPACITOR	C34
"	SEMICONDUCTOR	Q12
"	DIODE	D15

TORS ARE ½ WATT 1% UNLESS OTHERWISE SPECIFIED
33 - 50K ½ WATT ± 20%
0K ½ WATT ± 20%
37 10K ½ WATT ±10%

NOS. OMITTED
R43 - R45 - R49
R52

PREFIX "E"

Hq LTR.	REVISED FOR PREFIX	648 E.C.O.	APP'D	7-11-67 DATE
TOLERANCES FRACTIONS: ±1/32", DECIMALS: ±0.005" UNLESS SPECIFIED					
DRAWN BY W. J. WAGGLE DEC 22 '63	CHECKED [illegible] 1-3-64 19	APPROVED [illegible] 1-3-64 19			
IRD INTERNATIONAL RESEARCH AND DEVELOPMENT CORPORATION WORTHINGTON, OHIO			TITLE: ELECTRICAL SCHEMATIC MODEL 1222		
			NEXT ASSEMBLY USED ON D2-0820	DRAWING NUMBER D6-07147	